Oxidation of Titanium Beryllid Fablicated By plasma-sintering Process

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The establishment of the blanket technology is indispensable for realization of fusion reactors as an energy source. The neutron multiplier, which comprises the blanket, is necessary to generate tritium that is a fuel of fusion reactors. Metallic beryllium is considered as a candidate for the neutron multiplier. However, metallic beryllium is highly reactive with water vapor and oxygen at high temperature, and produces H_2 and BeO. Thus, it is required to develop a new neutron multiplier that is more chemically stable than metallic beryllium. Intermetallic compounds of beryllium such as $Be_{12}Ti$ and $Be_{12}V$ are to be an alternative material of the neutron multiplier. It was found that $Be_{12}Ti$ is highly tolerant to water vapor and oxygen, low swelling and better compatibility with structural materials.

The $Be_{12}Ti$ sample used in our previous experiments was fabricated by the HIP process.This time, we performed oxidation tests by the thermo-gravimetric technique, using a $Be_{12}Ti$ sample that was fabricated by a plasma-sintering process. $Be_{12}Ti$ was cut into a disk of 2 cm diameter and about 1 mm thick. The disk was further cut into 4 pieces and polished up to #800 grid by SiC paper. The sample was placed in regulated atmospheres of dry oxygen and humid air (P_{H2O} = 2.7 kPa). Experiments were carried out at the temperature of 1273 K and duration time was 24 h.

The mass gain of $Be_{12}Ti$ in dry O_2 and humid air appeared to be small, which is less than several gm^{-2} and was negligible. This result indicates that $Be_{12}Ti$ fabricated by the new process possesses a very good oxidation resistance to oxidation by O_2 and water vapor. Observation of the surface of the samples after the experiments reveals that these surfaces were somewhat oxidized but oxidation did not take place in the bulk of the samples. These results suggest that titanium beryllide possesses satisfactory oxidation resistance to oxidation for use as neutron multipliers.